

Ventilation Solutions

Paul Francisco
Indoor Climate Research & Training



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Ventilation

- ▶ Consensus standard is ASHRAE 62.2 (for residential)
- ▶ Has whole-building and local exhaust requirements
- ▶ Has alternate path for existing buildings with insufficient local exhaust
- ▶ Often – but not always – met using exhaust fans



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Considerations

- ▶ 62.2 does NOT require exhaust; there may be times when you want something else
 - Combustion safety concern
 - Though it is rarely the 62.2 fan that is the big issue
 - Humidity concern
 - Typically caused by non-porous materials like vinyl wallpaper
- ▶ When exhaust seems like a bad idea, consider supply or balanced



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Exhaust Fans - Options

- ▶ Use existing fans
 - If they are working ok
 - Just add an appropriate control
- ▶ Put exhaust into a bathroom or kitchen
 - Reduces the "local exhaust deficit"

- ▶ (Most of next bunch of slides courtesy Paul Raymer, from joint presentations in the past – indicated by "pr" in upper right)

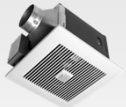
System Choices – Exhaust Fans



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System Choices – Exhaust Only

Panasonic




WhisperGreen^{Select} Panasonic

1 Fan=84 IAQ Solutions

- Multi-Speed (FV-11VK1)
- Ultra-Silent (FV-11VK1)
- LED Light (FV-11VK1)
- Plug 'N Play (FV-11VK1)

Six WhisperGreen Select Base Models:

- FV-05-11VK1: 130 to 110 CFM integrated multi-speed + LED Light
- FV-05-11VK1: 50-80-110 CFM single speed + LED Light
- FV-05-11VK1: 30 to 110 CFM integrated multi-speed
- FV-05-11VK1: 50-80-110 CFM single speed
- FV-11-15VK1: 110-130-150 CFM single speed
- FV-11-15VK1: 110-130-150 CFM single speed + LED Light

- Customizable, all-in-one fan and fan/LED light combinations
- Pick-A-Flow speed selector satisfies designed air flow
- Plug 'N Play technology provides up to three value added features
- Revolutionary DC motor with SmartFlow™ technology

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System Choices – Exhaust Only

Broan/Nutone



BROAN

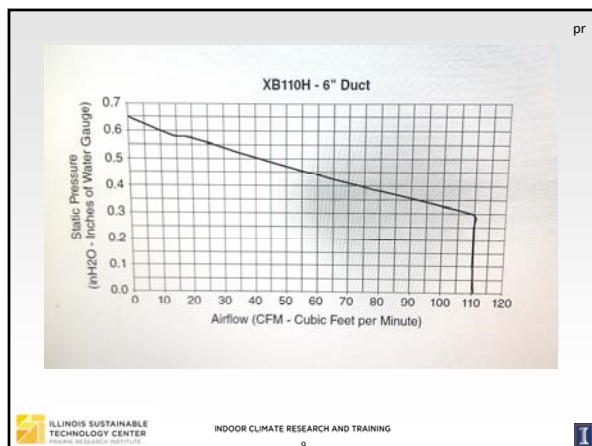
110 CFM
ULTRASense™ H, Humidity Sensing
Technology fans react to a quick rise in
humidity to turn the fan on;
ULTRASilent™ Sound Technology less than
0.3 Sones;

Power: 8.3 Watts

NuTone Ultra Series SB110H

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System Choices – Exhaust Only

Air King



- Model ESVD;
- 2 set up speeds;
 - Low 30, 40, 50, 60, 70, 90, 100, 120
 - High: 80, 110, 130, & 150
- Optional 26w night light;
- Optional motion sensor;
- Optional humidity sensor;
- All airflow below 130 cfm < 0.3 sones



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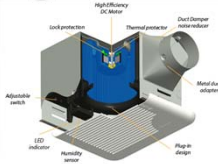
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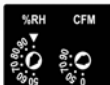
System Choices – Exhaust Only

DeltaBreez





CFM: 50 to 124
Sones < 0.3
Power: 5.6 to 20 watts
Humidity control




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System Choices – Exhaust Only

Fantech





FQ80L
Sones: 0.4
Power: 30 watts
Light: 26/4

FQ80
Sones: < 0.3
Power: 25 watts

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Exhaust Fans – Options

- ▶ Wall-mounted
 - If ceiling-mount isn't possible



▶ Example

Brand	Model	Flow	Sones	Duct	W	Cost
Panasonic	FV-08WQ1	70	1.1	N/A	18	~160

Local Exhaust – Kitchen Fans

Range hoods



Exterior mounted fan

Kitchen Exhaust Fan



Venmar S1311LS range hood with 40 CFM background & 75, 160, and 270 CFM on-demand speeds.

Dakota Supply Group

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System Choices – in-line fans

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In-line exhaust fans

Photos courtesy of Wisconsin Weatherization Program

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In-line exhaust fans

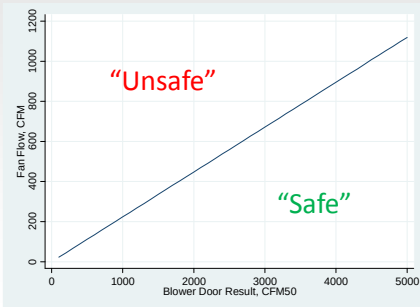
Motion sensing grille

In-line fan with lighted grilles

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Allowable exhaust flows, -5 Pa Limit



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Supply-only ventilation



©Residential Ventilation Handbook, McGraw-Hill, Raymer 2009

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Supply Ventilation to Furnace Return

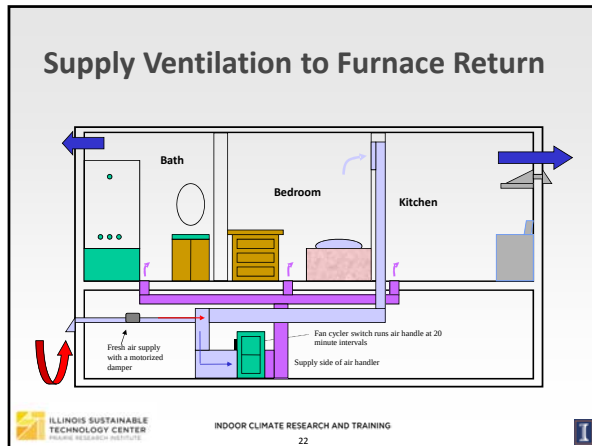
- ▶ Ducts must be tight (or they can bring in bad air);
- ▶ Must have good motorized damper;
- ▶ Must be controlled to run even if no heat is needed;
- ▶ Furnace fan energy use can be high;
- ▶ Intake must be kept clean of yard debris and other outdoor stuff.

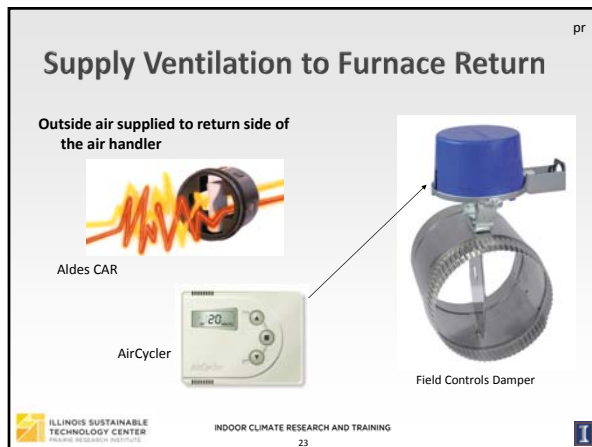
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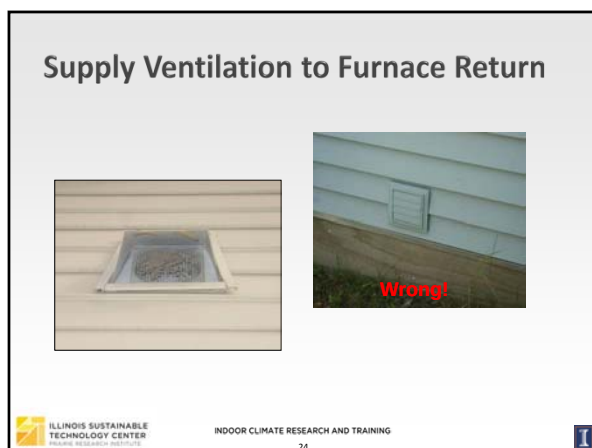
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Balanced ventilation

- ▶ Exhaust and supply ventilation should have equal cfm.
 - Balanced without recovery
 - Heat Recovery Ventilator (HRV)
 - unit transfers sensible heat only with no humidity transfer.
 - Energy Recovery Ventilator (ERV)
 - Unit transfers sensible heat and humidity.



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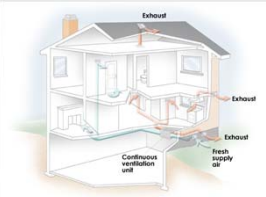
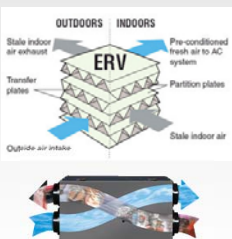
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Balanced with heat or energy recovery – dedicated ducting

Source: ©Residential Ventilation Handbook, McGraw-Hill, Paul Raymer, 2009



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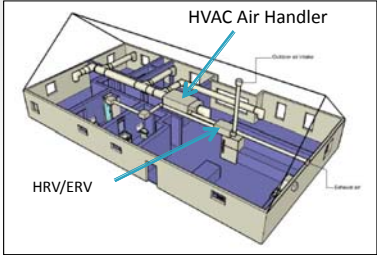
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Balanced HRV/ERV

Illustrates connection to the existing HVAC system



Source: 62.2 User's Manual ©2006 ASHRAE



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Primary System Design Choices –
Balanced with heat or energy recovery

2nd Law of Thermodynamics – Heat moves to cold, wet moves to dry

Heat Recovery Ventilator (HRV) transfers heat from the warm air stream to the cool air stream.

Energy Recovery Ventilator (ERV) transfers sensible and latent heat from warm, moist air stream to the cool, dry air stream.

Desiccant wheel ERV




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Heat Recovery Ventilators (HRVs)




Venmar HRV, inside view

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Heat Recovery Ventilators (HRVs)



Must be installed in an accessible place for service.
Should be inside the conditioned space for maximum efficiency.

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Primary System Design Choices – Balanced with heat or energy recovery

Different efficiency ratings for HRVs and ERVs

Sensible Recovery Efficiency (SRE) is the number that defines the "sensible energy recovered minus the supply fan energy and preheat coil energy, divided by the sensible energy exhausted plus the exhaust fan energy. This calculation corrects for the effects of cross-leakage, purchased energy for fan and controls, as well as defrost systems."



Single room ERV

Generic Specifications	64-146	108-235
CFM at low-high speed	83 %	77
Apparent sensible effectiveness at 0°C		
Warranty on components	5 years	5 years
Warranty on the core	Lifetime	Lifetime

This info is available on the HVI certification sheet.

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Controls

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62.2-2010/2013 Controls

Whole Building Ventilation

- ▶ “The ‘fan on’ switch on a heating or air-conditioning system . . . for systems introducing ventilation air through . . . an HVAC system”;
- ▶ “Readily accessible override control must be provided to the occupant”;
- ▶ “Local exhaust fan switches and ‘fan on’ switches . . . as override controls”;
- ▶ “Controls, including the ‘fan-on’ switch of a conditioning system, must be appropriately labeled.”

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Controls

Whole Building Ventilation

- ▶ ASHRAE 62.2-2010 requires that the occupant have the ability to shut the system off.
- ▶ Intermittent operation requires a timer or other control.
- ▶ It is critical that occupants know why the fan is running all the time and that turning it off may have an impact on their health and comfort.

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Controls

- For blower door testing, the ventilation system needs to be turned off.
- Some controls are multiple speed. Whole building ventilation is generally set to the lower flow.
- Both lower and higher flow rates should be tested.

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Controls

Local Exhaust Ventilation

- ▶ “Control devices . . . are permissible provided they do not impede occupant control”;
- ▶ Shut off timers;
- ▶ Occupancy sensors;
- ▶ Multiple speed fans;
- ▶ Combined switching;
- ▶ IAQ sensors;
- ▶ Etc.

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Controls

Local Exhaust Ventilation

- ▶ Standard wall switch;
- ▶ Delay timer;
- ▶ Crank timer;
- ▶ Motion detector;
- ▶ IAQ control.

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Humidity Control



Delay Timer



IAQ Control



Motion Detector



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Controls

Whole Building Ventilation

- ▶ Complies with 62.2-2010;
- ▶ “appropriately labeled”;
- ▶ “readily accessible”.
- ▶ But if installed in an obvious place, is likely to be turned off.

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Primary Ventilation System

Source: © Residential Ventilation Handbook, McGraw-Hill, Paul Rayner, 2009



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Controls

Whole Building Ventilation

Control alternatives:

- o “appropriately labeled”;
- o “readily accessible”
- o Both of these controls require circuit breaker or system override to shut off.



Honeywell
Will require reprogramming after shut down.

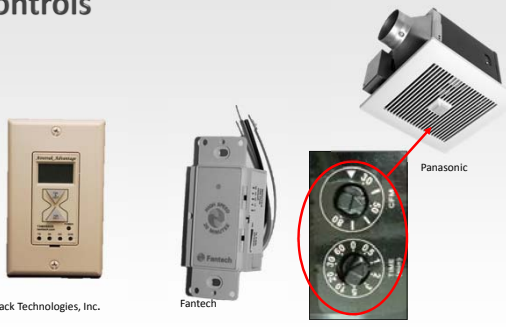
AirCycler

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Controls



Tamarack Technologies, Inc.

Fantech

Panasonic

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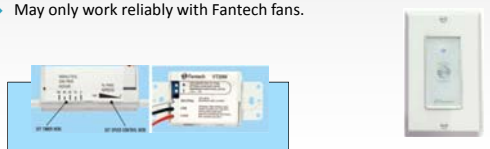
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Controls

Whole Building Ventilation

- Variable speed control;
- Push button override boost the fan to full speed for an adjustable time;
- Bright blue LED fan on indicator;
- Can be connected with a second control to a single fan;
- High speed should not exceed combustion requirements of section 6.4;
- No FAN OFF control (could set min/hour to 0);
- Not labeled as Whole Building Ventilation Control
- May only work reliably with Fantech fans.



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Results of bad terminations



Different attics

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System design choices – system distribution



Inexpensive to install but marginally effective and expensive to operate.

- Both systems have to run simultaneously;
- Stale air is not removed at polluting locations;
- Very difficult to balance.

Air handler return
"Stale" air from house
Fresh air to house
HRV

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System design choices – system distribution



Well filtered HRV installation
<http://www.ventsolutionsfbx.com/home>

Beautiful installations!
Ventilation Solutions Fairbanks, AK

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Install it so it works.
Design it right
Certified Fan Curve

Pannaspec
80-220C

FAN MODEL	Size	Speed	CFM	SP	W	HP
FAN070L1	7" Duct	@ 0.25" SP	66	1.2	18.2	
	8" Duct	@ 0.25" SP	48	0.9	10.1	
	8" Duct	@ 0.25" SP	54	0.8	10.1	
FAN070F2	7" Duct	@ 0.25" SP	70	0.8	14.2	
	8" Duct	@ 0.25" SP	52	0.6	10.0	
	8" Duct	@ 0.25" SP	60	0.6	10.0	
FAN070L2	7" Duct	@ 0.25" SP	70	0.6	10.6	
	8" Duct	@ 0.25" SP	57	0.5	10.7	
	8" Duct	@ 0.25" SP	63	0.5	10.1	
FAN080X1	8" Duct	@ 0.25" SP	80	0.3	11.6	
	8" Duct	@ 0.25" SP	82	0.3	11.6	
FAN080L1	8" Duct	@ 0.25" SP	80	<0.3	11.3	
	8" Duct	@ 0.25" SP	78	0.3	10.5	
FAN080M1	80 CFM speed	@ 0.25" SP	80	0.3	11.3	
	75 CFM speed	@ 0.25" SP	74	0.2	10.2	
	65 CFM speed	@ 0.25" SP	70	<0.2	8.9	
	60 CFM speed	@ 0.25" SP	66	<0.2	7.5	
	50 CFM speed	@ 0.25" SP	50	<0.2	5.2	
	45 CFM speed	@ 0.25" SP	45	<0.2	4.4	
	40 CFM speed	@ 0.25" SP	40	<0.2	3.7	
	35 CFM speed	@ 0.25" SP	35	<0.2	3.2	
	30 CFM speed	@ 0.25" SP	28	<0.2	2.7	

Graph showing Static Pressure (Pa) vs. Volume Flow Rate (CFM) for various fan speeds. The graph includes a legend for Static Pressure (green line with triangles) and Watts (blue line with circles). Two specific operating points are highlighted: 63 cfm at 62.5 pa and 80 cfm at 25 pa.

Legend:
 — Static Pressure
 — Watts

Operating Points:
 63 cfm at 62.5 pa
 80 cfm at 25 pa

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Low-cost strategies

Local/Whole-Building Combination

- ▶ Use high quality DC-motor fan to serve as local bathroom (or kitchen) ventilation and whole-building ventilation.
 - Best if bathroom is centrally located.
 - Bathroom door must remain open most of the time.
 - Undercut bathroom door for some communication when door is closed.
 - Not best practice, but complies with 62.2-2013.

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Broan Fan Upgrade Kit



690 Bath Fan Upgrade Kit

The BROAN bath fan upgrade kit lets you convert your old bath fan to a brand new unit in just 10 minutes. Improve performance, reduce the sound level, and upgrade the appearance of your economy fan in minutes.

Models	Duct Size	Sones	CFM @ 0.10"	Compare
690	3"	3.0	60	☐ Add

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Add control

- ▶ If there is a decent fan on a wall switch, can add a control that runs the fan on a schedule without requiring a new fan

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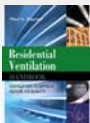
ASHRAE 62.2 Resources

www.ASHRAE.org **62.2 User's Manual** – available through Resources & Publications
Detailed step-by-step user guide through the Standard \$54.00

ASHRAE Guideline 24-2008
Beyond the Standard – details on IAQ, commissioning, and documenting \$54.00

Residential Ventilation Handbook
Paul H. Raymer, McGraw-Hill, 2010 \$52.45
62.2 System Checklist, Infiltration Credit & Existing Homes Credit spreadsheet, System Documentation Sheet www.HeyokaSolutions.com

Residential Energy Dynamics
<http://www.residentialenergydynamics.com/Home.aspx>
ResVent App for iPhone and iPad
www.karg.com/resvent622.htm



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Discussion?

For later questions/thoughts/comments:
pwf@illinois.edu
217-244-0667



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